

large and slowly-cooled ingots in which the maximum of segregation has taken place.

Mr. P. Eyermann (Benoit, Wisconsin) submitted a lengthy paper on the manufacture of solid rolled steel wheels and tyres. The average life of a cast-iron wheel is 56,000 miles in passenger service, while steel-tired wheels have a life of 265,000 miles. The author considers it probable that before long the solid rolled steel wheel will replace the existing tyres in Great Britain.

Mr. E. Lelong (Couillet, Belgium) described a new method of manufacturing chains by machinery in which the successive convolutions of spiral links are continuous. Chains made by this process are 20 per cent. stronger than those made by the usual methods.

Mr. C. O. Bannister (London) discussed the relation between type of fracture and microstructure of steel test-pieces, showing that valuable conclusions may be drawn from the examination of the fractured surface.

The effect of copper in steel was discussed by Mr. F. H. Wigham (Wakefield). Copper is very difficult to alloy with steel so as to obtain a homogeneous mass containing more than 2 per cent. even with the addition of aluminium. In steel containing 0.5 per cent. or more of carbon it is not of practical value to use more than 0.6 per cent. of copper. The steel with 0.25 per cent. of copper and alloys up to 0.25 per cent. of copper with high carbon (0.70 per cent.) give, with or without a high percentage of manganese, a good quality of wire. In fact, copper to the extent of 0.25 per cent. is no disadvantage in the manufacture of the best classes of steel wire.

The reports of research work carried out during 1905-6 by holders of Carnegie research scholarships, which were submitted, represented a large amount of work of great interest. An exhaustive study of quaternary steels was submitted by Dr. L. Guillet (Paris). For the research 250 varieties of steel were prepared, including nickel-manganese steels, nickel-chromium steels, nickel-tungsten steels, nickel-molybdenum steels, nickel-vanadium steels, nickel-silicon steels, nickel-aluminium steels, manganese-silicon steels, manganese-chromium steels, and chromium-tungsten steels. The area for the commercial employment of these steels is considerably restricted, and is limited to the nickel-vanadium steels, the nickel-tungsten steels, and the chromium-vanadium steels containing comparatively low proportions of foreign elements.

The report by Mr. W. Rosenhain (Birmingham) on the deformation and fracture of iron and mild steel constitutes a continuation of his previous paper on the plastic yielding of iron and steel. He gives further observations on slip-bands, and deals with the modes of fracture under various conditions. In tensile fractures the break runs almost indifferently through ferrite and pearlite, owing to the fact that the previous extension of the metal has weakened, and in part even ruptured, the pearlite; in shock fractures the pearlite is able to assert its superior strength and is avoided by the fracture, while fissures are formed in the ferrite. The features of bending fractures are found to be of an intermediate character. The results of the examination of these fractures are discussed both from the point of view of the relative behaviour and interaction of ferrite and pearlite under breaking stresses and from the point of view of the general theory of deformation and fracture which is presented in the paper. In conclusion, the author points out the possibilities of practical application which his method of studying fractures opens up. This detailed study of fractures makes it possible to locate accurately the causes of weakness and strength in a given microstructure, and by comparing the behaviour of the constituents when broken in different ways to gain a deeper insight into their mutual interaction; while the study of "mysterious" fractures occurring in service—as rendered possible by this method—should make it easier to trace the causes of fracture—if any—which are present in the metal.

Dr. H. C. Boynton (Harvard, U.S.A.) dealt with the determination of the hardness of the constituents of iron and steel with the aid of Jaggar's microsclerometer. Reduced to a common unit, the hardness of pure ferrite, the average hardness of the constituents was found to be as follows:—

Constituent	Present in	Average Hardness	Ratio
Ferrite . .	Electrolytic iron	460	1
" . .	" quenched	990	2.15
" . .	Average of all unhardened samples	610	1.03
" . .	Commercial wrought irons	686-1643	1.5-3.6
Pearlite . .	Series 0.13-1.52 per cent. carbon	842-4711	1.8-10.3
" . .	Series 0.35-0.86 per cent. carbon	1745-2150	3.8-4.2
Sorbite . .	0.48 and 0.58 per cent. carbon steel	2400-24,650	5.2-53.6
Troostite . .	Steel, 0.58 per cent. carbon	40,564	88.2
Martensite . .	Series 0.20-1.52 per cent. carbon	17,896-120,330	38.9-261.6
Austenite . .	White cast-iron (3.24 per cent. carbon)	47,590	103.4
Cementite . .	White cast iron (3.24 per cent. carbon)	125,480	272.8

Mr. J. D. Brunton (Musselburgh) submitted an elaborate report on the heat treatment of wire, particularly wire for ropes. He showed that the usual methods of obtaining the best wire by means of torsion and tensile tests are not altogether trustworthy for determining the best point for the wire to perform useful work. Annealing of the rod before the final annealing does not, in any way, produce better material, as it has been thought to do, and is, therefore, not necessary.

The research carried out by Messrs. E. G. L. Roberts and E. A. Wraight (London) comprised a series of 150 experiments and complete analyses, dealing with the constitution of ferromanganese and the efforts made to deprive this alloy of its carbon.

It was announced that the next meeting would be held in London at the end of July, when members of the American Institute of Mining Engineers would be the guests of the institute.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Prof. William Schlich, F.R.S., St. John's College, has been constituted by H.M. Secretary of State for India professor of forestry so long as he shall be continued in his present position and be resident within the University.

The first of two lectures on "The Teaching of Science in Schools" was given by Dr. Bevan Lean, headmaster of Sidcot School, on May 10 at the lecture room of the delegacy for the training of secondary teachers. The second lecture is to be delivered to-day.

CAMBRIDGE.—A Grace authorising the general board of studies to appoint, subject to confirmation by the special board for medicine, Mr. G. H. F. Nuttall, Christ's College, to be reader in hygiene in connection with the special board for medicine, the University lectureship in bacteriology and preventive medicine to terminate on his appointment as reader, will be offered to the Senate to-day.

Mr. W. J. Sell, Christ's College, has been approved by the general board of studies for the degree of Doctor in Science.

A university lectureship in mathematics will be vacant at Michaelmas, 1906, by the resignation of Mr. Whittaker. The general board of studies will shortly proceed to appoint a lecturer to hold office from Michaelmas, 1906, until Michaelmas, 1911. Candidates are requested to send their applications, with statements of the subjects on which they are prepared to lecture, and with testimonials if they think fit, to the Vice-Chancellor on or before May 31.

The Vice-Chancellor has been informed by the clerk to the Worshipful Company of Girdlers that the company is prepared to continue its grant of 100l. a year towards the teaching of economics for a second period of three years. The board of economics is of opinion that this offer should be gratefully accepted.

THERE seems every possibility of the Hamburg University being very quickly established. Three million marks have already been voluntarily subscribed, two millions of which have been given by Mr. Alfred Beit. It is proposed that only one-half of the lectures shall be given for direct preparation for any particular profession, while the other half are to be for the further extension of the general education of the inhabitants of the town.

HIGHER education is mostly left to take care of itself in this country, with the result that our statesmen and Governments do not know exactly where it is being carried on, or what provision has been made for it without their assistance. On the principle that what is everybody's business is nobody's business, no serious attempt has been made to take stock of our national resources as regards higher education, so it comes about that the committee recently appointed by the Chancellor of the Exchequer to advise the Treasury as to the distribution of the sum voted by Parliament for grants in aid to university colleges has sent an intimation to the public Press with the object of bringing the conditions under which grants are made under the notice of colleges which have not as yet communicated with the committee. It is obvious that if our higher education were properly organised by the State, the Minister of Education would have detailed particulars of institutions devoted to it, and such an announcement as that just issued, suggesting that there are many colleges unknown to the official mind, would have been unnecessary. The grants are given only to those institutions which afford education of a university standard in great centres of population in England. To qualify for a grant at present, a college is required to show that its local income for work of a university character is not less than 4000*l.*, and that of this sum at least 1500*l.* is derived from fees. Any college wishing to be included in the list of those receiving grants should send in an application not later than June 13. Applications should be addressed to the secretary to the committee, Mr. R. G. Hawtrey, at the Treasury, S.W.

PRESENTATION DAY was celebrated at the University of London on May 9, when Sir Arthur Rücker, the principal, read his annual report on the work of the University. An important event of the year was the recasting of the schemes of examination for the B.A. degree. Up to the present the course of study from the matriculation stage onward has been, with the exception of mathematics, entirely literary. The opinion that a mixed course of literature and science would be of the utmost value to many pass students has, however, for long been gaining in strength, and effect has now been given to it in the following manner. In future either Greek or Latin, but not both, will be compulsory both in the intermediate and in the final examinations for the B.A. degree. Another language will also be compulsory; while the other subjects required may be chosen from a list of languages, pure and applied mathematics, and the more fundamental sciences. The examinations in science will be identical with those for the corresponding subjects for the B.Sc. degree. It will thus be possible for a candidate for a pass B.A. degree to take either an exclusively literary course or a mixed course including Latin and one other language. Sir Arthur Rücker announced that the Senate has invited the University of Paris and the Collège de France to visit the University of London at Whitsuntide. This will be a unique event, no formal visit having hitherto been made by a French to an English university. A large number of distinguished guests are expected, and it is hoped that the occasion will bind closer the intellectual links which unite the two countries.

A DEPUTATION of the council of the Association of Technical Institutions was received by the President of the Board of Education on May 4. Sir William Anson, as president of the association, introduced the deputation, and stated that its object was to bring before the Board the importance of increasing the rate of grants to the day technical institutions and for instruction in the more technical subjects in evening classes. Sir William Anson referred to the importance of efficiently maintaining facilities for technical instruction, and pointed out the tendency of local authorities to devote their funds chiefly to elementary education, to the possible detriment of higher work. Sir Philip Magnus urged the importance of technological subjects in evening classes, and the great cost involved in their maintenance. Unless education authorities are encouraged to conduct such classes there is grave fear of their being neglected for subjects, not so important to the industries of the country, which receive higher grants. Sir William Mather spoke of the great importance of technical education for the maintenance of the industries of the

country, and the need for watching that money intended by Parliament for the maintenance of such work should not be diverted for other work. He thought an appeal might well be made to employers to contribute towards the cost of technical education. Mr. Birrell, in reply, said that the deputation might rest assured that the Board has every sympathy with the request put forward for increased grants for work in day classes in technical institutes. The Board fully realises the importance of the work which is done. Mr. Birrell, however, reminded the deputation that there are many other important branches of education which are in need of increased grants. In conclusion, he cordially supported what Sir William Mather said as to the importance of employers contributing to technical institutes. Mr. F. G. Ogilvie dealt with the way in which the Board is trying to include technical subjects as eligible for their grants, and so far as possible at the same rate as science subjects.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 5.—"On the Distribution of Radium in the Earth's Crust, and on the Earth's Internal Heat." By the Hon. R. J. Strutt, F.R.S.

Summary of Conclusions.—(1) Radium can easily be detected in all igneous rocks. Granites, as a rule, contain most radium, basic rocks the least. (2) This distribution of radium is uniform enough to enable a fair estimate to be made of the total quantity in each mile of depth of the crust. (3) The result indicates that the crust cannot be much more than forty-five miles deep, for otherwise the outflow of heat would be greater than is observed to be the case. The interior must consist of some totally different material. This agrees entirely with Prof. Milne's conclusion drawn from a study of the velocity of propagation of earthquake shocks through the interior. (4) The moon probably consists for the most part of rock, and, if so, its internal temperature must be far greater than that of the earth. This explains the great development of volcanoes on the moon. (5) Iron meteorites contain little, if any, radium. Stony ones contain about as much as the terrestrial rocks which they resemble.

Challenger Society, April 25.—Mr. E. W. L. Holt in the chair.—*Exhibits.*—Four species of *Cephalodiscus*, of which three had recently been described by the author, who also referred to others from the *Discovery* and *Antarctica* expeditions: Dr. S. F. Harmer.—Charts of positions in the North Sea, where, by means of a heavy conical dredge with canvas lining, samples of bottom deposits had been taken by the Marine Biological Association's steamer *Huxley*: J. O. Borley. Mr. Borley showed in action a sifting machine, designed by Mr. Todd and himself, for grading these deposits; sieves of various mesh, hung in water, were made to vibrate horizontally at high speed by an eccentric worked by an ordinary whirling-table. There were also exhibited specimens of the gravel, fine sand, and silt met with, charts of their distribution showing the extreme uniformity of bottom found over large areas in the eastern part of the North Sea, and diagrams indicating the very definite meaning attaching to fishermen's descriptive terms for the bottom.—Preliminary paper on *Medusæ* collected in H.M.S. *Research* by Dr. Fowler in the Bay of Biscay: E. T. Browne. The *Trachomedusæ* predominated over the other orders, three species forming about 85 per cent. of the specimens collected (*Aglantha rosea*, 42 per cent.; *Aglaura hemistoma*, 27 per cent.; *Rhopalonema coeruleum*, 15 per cent.). These were chiefly taken between 50 fathoms and 100 fathoms. A few rather rare species were taken below 100 fathoms; for example, *Colobonema sericeum*, one of the new deep-sea *Medusæ* discovered by the *Valdivia*. The most interesting find was a *Narcomedusan*, probably a new species of *Cunotacantha*, which had a number of medusa-buds in all stages of development upon the stomach-pouches; the buds were not parasitic, as in other species of *Cunotacantha* and *Cunina*, but develop directly from outgrowths of the stomach-wall. This forms a straightforward case of asexual gemmation, such as occurs in some *Anthomedusæ*.